US009410892B2

(12) **United States Patent**
Erickson et al.

(10) **Patent No.: US 9,410,892 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **NANOSCALE OPTOFLUIDIC DEVICES FOR MOLECULAR DETECTION**

(75) Inventors: **David Erickson**, Ithaca, NY (US); **Sudeep Mandal**, Lee, MA (US)

(73) Assignee: **CORNELL UNIVERSITY**, Ithaca, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1299 days.

(21) Appl. No.: **12/675,370**

(22) PCT Filed: **Sep. 2, 2008**

(86) PCT No.: **PCT/US2008/075066**

§ 371 (c)(1),
(2), (4) Date: **Sep. 14, 2010**

(87) PCT Pub. No.: **WO2009/029957**

PCT Pub. Date: **Mar. 5, 2009**

(65) **Prior Publication Data**

US 2011/0039730 A1 Feb. 17, 2011

Related U.S. Application Data

(60) Provisional application No. 60/935,774, filed on Aug. 30, 2007.

(51) **Int. Cl.**

G02B 6/12	(2006.01)
G01N 21/77	(2006.01)
B82Y 20/00	(2011.01)
G02B 6/122	(2006.01)
B01L 3/00	(2006.01)
G01N 21/78	(2006.01)

(52) **U.S. Cl.**

CPC ***G01N 21/7746*** (2013.01); ***B82Y 20/00*** (2013.01); ***G02B 6/12007*** (2013.01); ***G02B 6/1225*** (2013.01); *B01L 3/5027* (2013.01); *G01N 21/774* (2013.01); *G01N 21/78* (2013.01); *G01N 2021/7776* (2013.01); *G01N 2021/7789* (2013.01); *G02B 2006/1213* (2013.01); *G02B 2006/12061* (2013.01); *G02B 2006/12138* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,384,797	B1 *	6/2008	Blair	436/524
2005/0270633	A1 *	12/2005	Herman et al.	359/321

OTHER PUBLICATIONS

Erickson et al (2006 Optics Letters 31:59-61).*
Erickson et al (2005 Anal. Chem. 77: 4000-4007).*
Heilemann et al (2005 JACS 127: 3801-3806).*
Mandal et al (Proc. SPIE 6645, Nanoengineering: Fabrication, Properties, Optics, and Devices IV, 66451J; published Sep. 11, 2007).*

* cited by examiner

Primary Examiner — Christopher M Gross
(74) *Attorney, Agent, or Firm* — Perkins Coie LLP

(57) **ABSTRACT**

An optofluidic architecture for label free, highly parallel, detection of molecular interactions is based on the use of optically resonant devices whose resonant wavelength is shifted due to a local change in refractive index caused by a positive binding event between a surface bound molecule and its solution phase target. These devices have an extremely low limit of detection and are compatible with aqueous environments. The device combines the sensitivity (limit of detection) of nanosensor technology with the parallelity of the microarray type format.

6 Claims, 6 Drawing Sheets